U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF THE

CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY

FOR

1908.

BY

C. HART MERRIAM,
CHIEF.

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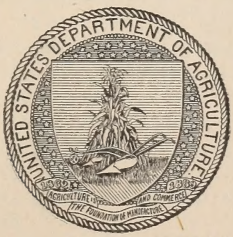

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CONTENTS.

REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., September 1, 1908.

Sir: I have the honor to transmit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1908, with outline of work for 1909.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

WORK OF THE BIOLOGICAL SURVEY.

The work of the Biological Survey as laid down by Congress is conducted under three general heads: (1) Investigation of the economic relations of birds and mammals to agriculture; (2) investigations concerning the geographic distribution of animals and plants with reference to the determination of the life and crop belts of the country; (3) supervision of matters relating to game preservation and protection, and the importation of foreign birds and animals.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

The study of birds and mammals in their economic relations assumes yearly more importance. The extension of agriculture to supply the needs of a constantly increasing population and to provide foodstuffs for export, the application of improved irrigation methods for the utilization of vast tracts of waste land, the introduction of new insect pests—these and other factors materially affect the distribution of animal life and disturb the balance of nature. Hence an accurate knowledge of the food and other habits of birds and mammals is necessary to the end that the beneficial kinds may be protected and the injurious kinds controlled.

The many problems in economic ornithology calling for investigation concern a large and increasing class of nature lovers and sportsmen and a still larger and vastly more important class, the farmers, on whose welfare ultimately rests the prosperity of the country. The various questions relating to the protection of insectivorous and game birds form important subjects of legislation in every State, and accurate information must be forthcoming as a basis for the

enactment of proper laws. So important is the preservation of certain species of migratory birds, especially ducks, geese, and shore birds, that ultimately the several States concerned may deem it expedient to intrust the legislation and police powers necessary for the protection and preservation of such species to National authority.

Experiments to determine the best and most economical methods of destroying wolves, coyotes, rabbits, ground squirrels, rats, and mice have been continued during the year.

WOLVES AND COYOTES.

Wolves and coyotes combined cause an annual loss to the stockmen and farmers of this country of several million dollars, and in some of the Northern States wolves threatened to exterminate the deer over considerable areas, both of wild and preserved land. Most of these losses are believed to be preventable, provided intelligent and concerted action on the part of farmers and stockmen can be secured. Early in 1907 a bulletin and two circulars containing directions for trapping and poisoning wolves and coyotes, and for finding their breeding dens, were widely distributed in the wolf-infested States, with the result that during the year many more of the animals were killed than previously. The total number of wolves killed was over 1,800, while about 24,000 coyotes were destroyed. The estimated saving of stock effected is not less than $2,000,000. During the present year another circular (No. 63), bringing the subject up to date, has been distributed for the purpose of renewing interest in the work and still further diminishing the number of the pests.

It is thought that in some sections at least the surest and most economical method of protecting stock, especially sheep, against the assaults of wolves and coyotes is by means of wire fencing, and several experiments having this end in view have been tried. During the present season, at the request of the Forest Service, specifications were drawn for a wolf- and coyote-proof fence to inclose an experimental sheep pasture in the Imnaha National Forest, Oregon. After completion, the fence was inspected by an assistant of the Survey and found to be well constructed. Reports upon the efficiency of this experimental fence are about to be published by the Forest Service.

FIELD MICE.

During the year an extraordinary infestation of field mice occurred in the neighborhood of Lovelocks, Nev., recalling in the extent of damage done the disastrous plagues of field mice in Europe, hitherto happily absent in this country. The alfalfa crop in the Humboldt Valley was badly damaged, and in places absolutely ruined, so as to necessitate replanting. The mice first ate the stalks and leaves and then devoured the roots. The damage to crops in the region infested for one year is estimated at some $250,000. This is an earnest of what may be expected when the irrigation projects now in hand are completed, and thousands of acres of desert are brought under water and made to produce crops. This same species of meadow mouse inhabits a wide region, and only awaits favorable opportunity to multiply and become a scourge.

When the necessary cooperation of the farmers of a community can be obtained, prevention is comparatively easy and cheap. Where, however, field mice are allowed to multiply, as in Nevada, until on certain ranches they reach the startling total of 10,000 to 12,000 to the acre, the reduction of their numbers to a point of safety is very difficult and expensive.

The Nevada outbreak furnishes an important object lesson as to the value of certain birds and mammals to the farmer. As soon as the mice began to increase markedly, hawks, owls, ravens, gulls, and herons among birds, and badgers, skunks, weasels, foxes, and coyotes among mammals hurried to the scene and made the pursuit of mice the chief object of life, most of them in fact subsisting entirely on the mice. It was estimated that during the height of the outbreak the birds and mammals enumerated destroyed some 45,000 mice daily. Although their combined assaults unaided did not suffice to abate the plague, yet when the number of mice was reduced by poison, and long before it approached the normal, they were able not only to prevent increase but to cause a rapid decline, which continued until the mice became so scarce that the predatory birds and mammals were forced to scatter and look elsewhere for food. It is fair to infer that had these friends of the farmer been protected in the beginning they would have been able from the first to hold the mice in check, preventing the abnormal increase so that there would have been no plague.

A preliminary report on field mice has been already published. A special report on the Nevada outbreak will soon be ready, followed by a general article on field mice, discussing the danger of their excessive multiplication, the nature of the damage they do to crops, especially alfalfa, and the best methods of reducing their numbers.

HOUSE RATS.

The entire civilized world is awakening to the importance of waging a war of extermination on rats. Wherever the subject is investigated the amount of damage done by these rodents is found to reach an appalling total—a total which justifies the expenditure of large sums in checking the waste. Accurate statistics of the injury done by rats and mice in the United States have heretofore been wanting. In January and February of the present year careful investigation was made of the losses in the cities of Washington and Baltimore. About 600 firms and individuals engaged in handling foodstuffs or other merchandise were interviewed. In Washington the losses sustained by merchants; marketmen, grocers, and proprietors of other business establishments were estimated at $200,000; and the losses to private citizens in residences were found to be approximately the same, bringing the total, including the sums spent in fighting the pests, up to $400,000. In the much larger city of Baltimore conditions proved to be very similar, and the total loss there was estimated at $700,000.

Assuming the conditions in these two cities to be typical, the losses in cities of 100,000 population or upward throughout the United States reach a total of $20,000,000. This takes no account of the losses in towns, villages, and the smaller cities, or of the losses on

poultry and eggs and on grain and other crops, which aggregate fully $30,000,000 more—in all, upward of $50,000,000 a year.

This is serious enough, but it is by no means the most serious aspect of the rat question, for rats are now known to be active disseminators of plague and other fatal diseases, and Professor Koch considers them "the chief agent in the diffusion of plague;" on which account they are much more to be dreaded than as destroyers of property.

In San Francisco and other maritime cities the boards of health, assisted by the United States Public Health and Marine-Hospital Service, are at the present time prosecuting active war against them, but, unhappily, without marked success. The Biological Survey also has continued its experiments with various means of destroying rats, without the discovery, however, of any single agent or method which can be recommended as effective under all circumstances. Professor Kitasato tells us that in Japan, where the number of rats killed each year sometimes reaches a total of a million, "nevertheless at the present day no appreciable diminution in the number of the rodents can be noticed. Reproduction keeps pace with destruction, so that we are at a loss to know how to proceed." For the present, at least, comparative immunity from these dangerous rodents is to be obtained only by employing several more or less effective methods, as traps and poisons, and by continued cooperative effort on the part of communities.

DEER FARMING.

The game animals of the United States are rapidly diminishing in numbers, and, whereas venison was formerly abundant and cheap, to-day it is seldom to be found except on the tables of the wealthy. This diminished supply is largely the necessary result of the cultivation of large areas of land not long since inhabited by wild animals. The setting aside of tracts of the public domain to conserve our rapidly diminishing forests and as refuges for valuable and interesting forms of animal life is therefore wise and timely. It is evident, however, that further steps are necessary if venison is to cease to be a mere luxury and is to become a food available for all.

The rearing of elk and other kinds of deer in confinement for conversion into venison, and even their domestication, appears to offer no greater obstacles than the rearing and domestication of cattle. The most serious impediment to the success of the business is State game laws. These naturally have been framed for the sole purpose of protecting wild game; hence the provisions respecting the killing, transportation, and sale of game animals are such as to practically prohibit the raising of deer for venison, and, in some States, even their sale for purposes of propagation. It is believed, however, that a complete understanding of the purposes of deer farming, especially a realization of the fact that it is one of the surest methods to insure the continued existence of the several species of the deer family, will result in so modifying existing laws as to permit the marketing of venison raised in confinement under such regulations as in no wise to jeopardize the safety of wild game.

As a result of investigations by the Survey, including correspondence with persons who have already made a success of raising deer, a bulletin has been issued setting forth briefly the advantages of deer

farming and giving details necessary for undertaking the business for profit. Not the least important purpose is the utilization of tracts of land unsuited to agriculture, but well adapted to deer farming. It is believed that the dissemination of information on the subject will result in the establishment of an important industry, profitable alike to the individual and to the State.

FOX FARMING.

From earliest times fur-bearing animals have formed an important part of the resources of the United States. Their skins constituted an essential part of the winter raiment of the aborigines, and later proved no less important to white men, both as wearing apparel and as a source of profit. So persistently have the fur-bearers been pursued and so greatly have their former homes been encroached upon by civilization that they are now comparatively scarce and are constantly diminishing. The finer furs are already so costly as to be beyond the reach of the many, and the supply even of the less desirable kinds by no means equals the demand. Foxes furnish an excellent quality of fur, that of the silver fox being especially fine and bringing a high price. Though rearing foxes in confinement can scarcely be said to have advanced beyond the experimental stage, enough has been done in this direction to prove that under proper conditions and in the hands of skilled men several kinds, including the silver-black fox and the blue fox of Alaska, can be reared in captivity profitably and with little difficulty.

Considerable data in relation to the business have been obtained, and a bulletin has been issued setting forth the conditions under which the industry is likely to be successful, and describing the best methods of pursuing it. It is believed that, without seriously interfering with their other occupations, many farmers in the northern part of the country can give sufficient time and care to the raising of foxes to insure ample returns for the time and capital required.

EXAMINATION OF BIRD STOMACHS.

Field investigations and laboratory examinations of the food of birds are carried on simultaneously for the double purpose of ascertaining exactly what each bird eats and of furnishing field assistants valuable hints as to the birds most profitable to study.

A few years ago our knowledge of the food of birds was dependent almost wholly on field observations. However carefully made, these prove quite inadequate as a basis to definitely fix the economic status of a given species, whether beneficial or injurious to agriculture. For this, careful examination and accurate determination of the contents of birds' stomachs are necessary. The present force engaged in this work is entirely inadequate to the magnitude of the task, and can do little more than keep abreast of current work, leaving the large accumulation of past years untouched. The economic status of a given bird, when once determined for a given region, is fixed for all time, at least in essentials, since changes in the food habits of birds are rare and occur chiefly when new plants and insects find their way into the country. It is hoped that in the near future the force now employed

in this important field may be augmented, so that the large amount of material now on hand can be studied and the results published for the benefit of farmers, orchardists, and others. During the past year 3,073 stomachs were received from various sources, and 3,387 (including some already on hand) were examined and their contents determined.

RELATION OF BIRDS TO THE COTTON BOLL WEEVIL.

Investigations of the relations of birds to the cotton boll weevil were continued in Louisiana, and several additional species were found to feed on the insect, bringing the number of birds now known to eat the weevil up to 54. Some species appear to eat it only casually, as it happens to come in their way. Others appear to be fond of the beetles and to make special search for them. Thus titlarks prove to be active destroyers of the beetle in winter, 34 out of 68 birds examined having eaten a total of 120. Varying thus in the number they destroy, all are important—some more, some less—in checking the increase of the weevil, which is one of the most noxious of our insect pests. A supplementary report on the subject has been issued, which, together with the circulars and reports of previous years, has been widely distributed in the districts already infested by the weevil, and also in the region of its probable extension.

It is highly probable that ultimately the pest will invade every foot of the cotton-producing area, and it is important that an accurate knowledge of the part birds play in checking its increase be widely disseminated in advance. It is not too much to expect that the laws of every cotton-producing State shall protect all birds which eat the boll weevil; and it is of even greater importance that every farmer in the cotton States shall be fully informed as to the nature and extent of the services such birds render, particularly as the numbers of some of the more important species may be increased by affording them protection and added opportunity for nesting. If their numbers are materially augmented in the territory not yet invaded by the pest, they may not only to some extent delay the spread of the insect, but later will permanently keep down its numbers.

CALIFORNIA BIRDS IN RELATION TO THE FRUIT INDUSTRY.

For several years investigations have been carried on in California to determine the exact relations of birds to the fruit industry, that the orchardists may learn to discriminate between the useful and injurious kinds, to the end that they may protect the useful kinds and adopt preventive measures against the others. Part I of a report on the subject was completed last year and widely distributed, and the manuscript of Part II has been finished and is now nearly ready for the printer.

FOOD OF WILD DUCKS.

Investigations of the food of wild ducks continue, with the view of securing information upon which to base legislation for establishing a proper open season for this important group of food birds. Great difficulty is experienced, however, in securing an adequate amount of

material. Some progress was made in the work during the year, and more than 1,100 duck stomachs are now on hand, almost all of which have been examined and the contents identified.

FOOD OF WOODPECKERS.

In 1895 a preliminary report was issued on the food of woodpeckers. Though the material in hand at that time was far from sufficient, valuable conclusions were reached, the evidence justifying the conclusion that woodpeckers are indispensable in the work of forest preservation. Since then every effort has been made to secure additional material, and now nearly five times as many stomachs are on hand as were available twelve years ago. Examination of the contents of these is now being made with a view to a final report on the subject.

MOSQUITO-EATING BIRDS.

The discovery of the part mosquitoes play in spreading such diseases as malaria and yellow fever has naturally called attention to these little pests and to economical methods of exterminating them. That some birds eat mosquitoes has long been known, and recently it has been found that more species eat them than was formerly supposed, and that certain species eat them in such numbers as to constitute an important check on their increase. Accordingly the subject is being studied with a view to determining what birds lend the most valuable aid; among the number are now known to be the chimney swift, nighthawk, northern phalarope, and killdee. Since the nighthawk and killdee are sometimes shot for food, their mosquito-eating habits should be widely known so that the birds may be protected. Further investigations in this field will be necessary, particularly in the Southern States, before a report can be made.

BIRDS IN RELATION TO THE CODLING MOTH.

Preliminary data on the relations of birds to the codling moth show that no fewer than 22 species of our native birds feed on this destructive insect, to the spread of which they constitute an important check. Further studies will be made of the part birds play in lessening the numbers of this pest.

GROSBEAKS.

Work on the economic relations of the grosbeaks begun in 1905 was completed in 1906, and a report on the subject was issued and distributed during the fiscal year 1908, thus making available for public use a knowledge of the food habits of this group of useful birds.

SPREAD OF THE ENGLISH SPARROW IN SOUTHERN CALIFORNIA.

Special work was done in California in checking the spread of the English sparrow. Prior to 1906 the English sparrow was unknown in southern California, but in the autumn of that year a small colony was reported at Newhall, Los Angeles County. The five southern

counties of the State (San Bernardino, Orange, Riverside, Imperial, and San Diego) are still free from the bird, and the conditions in Los Angeles County are favorable for its destruction before it has become established. Taking advantage of a visit to Los Angeles in August, a representative of the Survey visited Newhall in company with the county game warden. The colony there proved to be a small one and all sparrows that were seen were killed. The attention of several of the residents of the place was called to the presence of the bird and the necessity for checking its increase.

Later the bird was reported at Lancaster, Palmdale, Saugus, and one or two other points on the Southern Pacific Railroad north of Newhall, and at Victorville, in San Bernardino County, on the line of the Santa Fe road; and on May 31, 1908, the county game warden found a few English sparrows in the city of Los Angeles. The following day, at the request of the warden, the matter was laid before the county board of supervisors by the Department's representative, and attention was called to the importance of destroying the birds already in the city before they could spread to the neighboring fruit-growing districts. An appropriation of $250 was voted immediately by the board for beginning the work of stamping out the pest.

Considering the interest already aroused in the presence of the bird in southern California and the prompt action of Los Angeles County, it should be possible without much difficulty to check the further increase of the species in this region. The western extension of the Mohave Desert between the parallel ranges of mountains on the north and south prevents the bird from spreading southward very rapidly from the San Joaquin Valley, and the rugged ranges of mountains in Santa Barbara and Ventura counties also tend to check its spread coastwise. If the small colonies south of Tehachapi and Ventura, less than half a dozen in number, and the outlying colony reported at Victorville are destroyed, the English sparrow can probably be excluded indefinitely from the great fruit-raising section of southern California.

MEANS OF ATTRACTING BIRDS.

The importance of insectivorous birds in the continual warfare necessary against insect pests is now generally recognized, and most of them are everywhere protected by law. It is inevitable, however, that the rapid utilization of our wild land and the consequent diminution of our forested areas will result in greatly diminishing the numbers of certain species by destroying their breeding grounds and diminishing their food supply. It is important to counteract these and other injurious influences by making other provision for the welfare of our birds. One of the easiest and most important measures is providing an increased food supply by planting about houses and gardens fruit-bearing trees and shrubs, such as mulberries, wild cherries, and others. Such trees serve a threefold purpose: They are ornamental, provide food for useful species, and serve to protect valuable fruit from attacks by birds. A report on the subject has been delayed by pressure of other work, but, pending publication, information as to the best kinds of trees and shrubs for the purpose under various climatic conditions will be furnished on application.

GEOGRAPHIC DISTRIBUTION.

As in former years the Survey has conducted extensive field work for the purpose of gathering information concerning the distribution, abundance, and habits of our native birds and mammals. The results serve as a basis for mapping the life zones of the United States and also the distribution of the species. In addition to these important data the assistants in this branch of work accumulate much information concerning the food habits and relative abundance of the various species. This knowledge is essential for a proper classification of the species into beneficial and harmful groups. The wide acquaintance of the field naturalists of the Survey with the animal life of the country and with the habits of the various species is of great value in devising means of combating the injury to agriculture by the noxious species.

The investigations in this branch of the work during the year have been varied and have covered widely scattered parts of the country. Dr. C. Hart Merriam continued his work on the life zones of California and added materially to the data already accumulated. Vernon Bailey spent several months in southern California, and visited Oregon and North Dakota, collecting material for mapping the life zones of these States, and gathering information on the economic relations of birds and mammals. He also visited Humboldt Valley, Nevada, and made a preliminary investigation of the plague of field mice on the alfalfa ranches of that section, and the damage by burrowing rodents to the irrigation ditches of the Carson-Truckee irrigation project. As a result of this and previous work a bulletin was prepared on the harmful and beneficial mammals of the Carson and Humboldt valleys of Nevada. Later Mr. Bailey inspected the experimental wolf-proof sheep fence built by the Forest Service on the Imnaha National Forest, Oregon.

Merritt Cary completed the biological survey of Colorado, and his map and report on the work are nearly ready for publication.

W. H. Osgood spent July and August in northern New England and eastern Canada, making a survey of that region and gathering information for a report on fox farming, which has been published as Farmers' Bulletin 328. E. A. Preble completed the report on his work in Canada, which is now being published as North American Fauna No. 27. H. C. Oberholser completed for publication a report on the Economic Relations of the Birds of Texas. A. H. Howell made a trip to Louisiana to study the relations of birds to the cotton boll weevil. E. A. Goldman was employed from July, 1907, to February, 1908, in studying the distribution and economic relations of birds and mammals in central California. W. W. Cooke continued his study of the migrations of birds and completed for publication a bulletin entitled Distribution and Migration of North American Shore Birds.

During the year the office of Geographic Distribution has made considerable advance in mapping the distribution of American birds and mammals, and in getting its accumulated data into shape for convenient reference and use.

GAME PROTECTION.

The United States, with its great tracts of wilderness, its large and diversified supply of game, and its varied climates, furnishes many

attractive hunting grounds. Its big game embraces deer of several kinds, moose, elk, caribou, antelope, mountain sheep, and mountain goats; and its winged game includes the ruffed grouse, blue grouse, prairie chicken, and several other members of the grouse family, the quail, the wild turkey, the woodcock, snipe, various shore birds, and myriads of waterfowl. The pursuit of these numerous and varied species of game offers to our own citizens a healthful and enjoyable recreation, and attracts sportsmen from other parts of the world. The number of hunters annually in the field probably exceeds 3,000,000. With this army of sportsmen scouring the country and with the wilderness constantly decreasing through the encroachments of civilization, the problem of game preservation becomes yearly more difficult, and the duties of the office of Game Protection correspondingly grow in importance and complexity.

Difficult problems attach also to the task of preserving the non-game birds of the country. Capture of native birds for millinery purposes and for the cage-bird market is under fairly good control; but questions that press constantly for settlement arise through absorption of breeding haunts to meet the needs of spreading civilization, the great increase in the number of persons who shoot birds, and other agencies of depletion resulting from changed conditions.

In dealing with these problems several lines of activity are followed. Solutions are sought through enforcement of the Federal law prohibiting interstate commerce in game and birds which have been illegally killed, cooperation with State authorities and protective organizations in securing suitable State laws and enforcing those on the statute books, acquisition and publication of information bearing on the needs of game and bird preservation, and the performance of such other functions, active and advisory, as occasion requires.

Another phase of activity results from the duty imposed by the Lacey Act of supervising importations of live mammals and birds. Perpetual vigilance is required to prevent the introduction of species likely to prove ineradicable pests and so bring about a repetition of the disastrous results that followed the acclimatization of the English sparrow. Efforts to import and liberate dangerous species are not infrequent—several were made during the past year—and the success of even one attempt would probably entail serious losses, such as have occurred in other countries less carefully guarded. While, therefore, certain branches of the Department add large sums to the annual profits of agriculture, the careful check maintained by the Survey is a service less obvious but no less important, for it prevents losses amounting to many thousands of dollars a year.

The special work along these various lines during the past year will be considered under different heads.

IMPORTATION OF FOREIGN MAMMALS AND BIRDS.

In the supervision of importation of mammals and birds into the United States such consignments as offered opportunity for the entry of prohibited or dangerous species were closely scrutinized by inspectors of the Department stationed at New York and Philadelphia, the main ports of entry, and, so far as known, no violation of the law occurred. An attempt was made to import two specimens of mongoose (*Crossarchus fasciatus*) at New York on January 6, but entry was denied, and the animals were reshipped to Bremen, Germany. In February an application was received for the entry of 120 Hun-

garian hares, some of which were intended for crossing with Belgian hares, while others were to be used in stocking game covers. Many species intended to be kept in captivity are admitted that are denied admission when intended to be liberated; European hares are in this category; hence the consignment in question was not permitted to enter until assurance was given by the importer that none of the hares would be set free. In the same month entry was denied of a consignment of song thrushes which it was designed to liberate on Coney Island, and also of a shipment of 200 skylarks imported for liberation in Santa Cruz County, Cal. During the year 103 consignments were inspected, of which 99 were entered at New York and the remainder at Philadelphia. An additional inspector was appointed at Honolulu to act during the absence of the regular inspector, and the inspection service at that port was placed on the same basis as that at New York and Philadelphia, the Department paying a fee of $5 for each inspection.

The total importations of the year under permit comprised 305,595 canaries, 14,694 game birds, 42,915 miscellaneous birds, 1,520 mammals, and 592 eggs of game birds. The increase in game birds was 4,579, mainly due to the large number of European partridges imported for stocking covers, 7,781 being brought in, as against 3,075 in the preceding year. Among the rare pheasants imported for aviaries were 2 Bornean firebacks, 4 Siamese firebacks, 18 tragopans, 2 Formosan pheasants, and 2 "Sultan" pheasants (from Turkey and probably a local variety of the English pheasant, *Phasianus colchicus*). So far as known to the Department, this is the first time the Formosan and "Sultan" pheasants have been imported. The more important miscellaneous birds included 2 bower birds, 3 brush turkeys, 2 crested screamers, 2 drongo-shrikes, and 15 Brazilian bellbirds. The number of eggs of game birds imported showed a decided falling off; this year's importations were exceeded by last year's by 5,318. During the year there were imported without permit 19,690 canaries, 6,072 parrots, 4,596 miscellaneous birds, and 438 mammals. The total importations from July 1, 1907, to June 30, 1908, were, therefore, 325,285 canaries, 68,277 other birds, 1,958 mammals, and 592 eggs of game birds.

Personal examination was made of conditions at the principal ports on the Pacific coast. Seattle and Tacoma, Wash., now have several direct steamship lines to the Orient, but the bird trade there is still inconsiderable. As soon as this trade increases to any extent the services of a special inspector will be required in one or both of these cities.

BIRD RESERVATIONS.

Within the year the President has set aside nine additional bird reservations. The date of establishment, name, and location of each of these are as follows:

Aug.	8, 1907	Tern Island Reservation, Louisiana.
	17, 1907	Shell Keys Reservation, Louisiana.
Oct.	14, 1907	Three Arch Rocks Reservation, Oregon.
	23, 1907	Copalis Rock Reservation, Washington.
	23, 1907	Quillayute Needles Reservation, Washington.
	23, 1907	Flattery Rocks Reservation, Washington.
Dec.	7, 1907	East Timbalier Island Reservation, Louisiana.
Feb.	24, 1908	Mosquito Inlet Reservation, Florida.
April	6, 1908	Tortugas Keys Reservation, Florida.

Of these reservations Tern Island, Shell Keys, and East Timbalier Island consist of small uninhabitable islets along the coast of Louisiana, frequented by large numbers of terns, gulls, brown pelicans, and man-o'-war birds. Three Arch Rocks Reservation comprises a group of small unsurveyed basaltic islands off the coast of Oregon, tenanted by gulls, cormorants, puffins, guillemots, and oyster-catchers, and by dense colonies of murres. In the past, birds on these islets have been wantonly shot by visiting excursionists, but hereafter visitors will be allowed only under permit. The Washington reservations embrace about 130 rocky islets of no agricultural or commercial value, lying along the coast from Grays Harbor to the Straits of Juan de Fuca. They are inhabited by such birds as are found on Three Arch Rocks Reservation and, in addition, a large number of auklets and petrels. Their total population is estimated to consist of 100,000 petrels and 60,000 other birds. A few small herds of sea lions add to the attractiveness of the fauna. Mosquito Inlet Reservation, Florida, is a feeding place for several kinds of birds, including the pelicans of Pelican Island, a few miles to the north. It is composed of small mangrove and salt grass islets, shoal sand bars, and sand spits in and near the mouths of the Halifax and Hillsboro rivers, Florida. Tortugas Keys Reservation comprises the group known as the Dry Tortugas, near the western extremity of the Florida Keys, and is a breeding ground of sooty, noddy, and least terns, frigate birds, and other species. Its designation as a bird reservation does not interfere with its use for military purposes.

Reports from the warden of Pelican Island Reservation indicate a steady increase of the bird life of that island. The pelicans began arriving October 7, a month earlier than usual, and by February numbered 8,000 adults and 2,000 young. There was considerable mortality among the latter owing to unfavorable weather, and fully 500 died of cold and exposure. Early in April nesting was resumed, and a second brood of 600 or more was successfully raised. The island was visited by seven parties of tourists during the spring.

The attention of the Bureau was called to illegal shooting of birds on Chandeleur Island, a light-house station near Breton Island Reservation. The matter was taken up with the Department of Commerce and Labor, which revoked a permit to fish on Chandeleur Island, held by the offender, and directed the light-house keeper not to permit him to land thereafter.

PROTECTION OF GAME IN ALASKA.

A new Alaska game law was passed at the recent session of Congress and was approved by the President on May 11, 1908. The principal changes provide for hunting licenses, export licenses, and guide licenses, to be issued by the Governor of Alaska, who reports the details of the issue of such licenses to the Secretary of Agriculture; provide for support of the enforcement system by annual appropriations to be made on estimates submitted by the Secretary of Agriculture; and authorize the Governor to appoint game wardens. Under the law as it now stands, the Department continues to issue permits for scientific collecting and for export of specimens for propagation, exhibition, or scientific purposes, but those who desire to hunt for sport in Alaska or to export trophies from the District must apply to the Governor for the necessary license.

The number of permits issued by the Department for the export of trophies up to the date of approval of the bill was 34; 16 permits were also issued during the year for collecting and exporting scientific specimens, so that the total number of permits was 50.

INFORMATION CONCERNING GAME.

An important feature of the work connected with the preservation of birds and game is the collection and dissemination of information concerning game and nongame birds, many requests for which were received during the year.

Game Laws of the United States and Canada.—The usual summary of provisions concerning close seasons, shipment, sale, licenses, and bag limits was issued as Farmers' Bulletin 308 and was widely distributed among sportsmen and others interested, especially in those States which have no compilation of their game laws. The great demand for this summary attests its usefulness. The large posters giving the close seasons in the United States and Canada in tabulated form were also issued and widely distributed as usual.

Game Protection in 1907.—In the résumé in the Yearbook of the year's progress in game protection, particular attention was given to the condition of the game of the country, which, generally speaking, was very encouraging. The increase in the importation of partridges and pheasants from Europe was mentioned, and sportsmen were advised to devote their efforts to increasing native game birds rather than to importing foreign species, the ultimate value of which is problematical. Attention was called also to the growing practice of raising game in confinement and the need of laws permitting the marketing of such game under restrictions that will prevent the illicit sale of wild game.

Stocking Covers.—Much information was gathered from breeders, dealers, and game preservers concerning the propagation of game birds, the number and species of birds raised, the methods followed, and the degree of success attained. Importations of eggs for hatching were followed up, and the results obtained through this method of introducing game birds were ascertained. Such information is in frequent demand by correspondents and will be needed in the preparation of publications now in contemplation.

Game Preserves.—The collection of data relating to the private game preserves of the United States was continued, and much information was gathered for future use, especially concerning the numerous duck preserves in California. Attention was paid also to the game preserves of other countries, from which many useful points of comparison with our own may be drawn.

Thanksgiving Game.—Data concerning prices and abundance of game in the markets immediately preceding Thanksgiving Day were collected as usual. The material on hand now covers four years, and furnishes an excellent index to the relative prices and abundance of game.

History of Game Protection in Michigan.—Data were gathered for a résumé of the history of game protection in Michigan from the earliest times to date, and this is now being prepared for the press.

QUAIL DISEASE.—Little additional information has been obtained regarding the disease which made its appearance two years ago among quail in transit for restocking covers. This dearth of new knowledge is due mainly to almost complete discontinuance of such shipments, chiefly because of laws prohibiting such export from the States which have been the chief source of supply, but partly because of the uncertainties introduced by the prevalence of the disease. Several reports of the appearance of disease among wild quail were investigated, but were found to be without foundation.

COOPERATIVE WORK.

Much work was done as usual in cooperation with other Departments, State game officials, and game and bird protective organizations. A meeting of the association of game wardens, held in the Yellowstone National Park in August, 1907, was attended by the chief of the office of Game Protection. These gatherings of the chief game officials of the various States are of great importance to game protection, and in view of the close relationship between this subject and forest protection and the present tendency on the part of State legislatures to place both under one head, the Forester, at the suggestion of this office, directed officials of five National Forests to attend as representatives of the Forest Service. At the instance of this office the association adopted a resolution looking to cooperation between the National Association of Game Wardens and the American Breeders' Association, with a view to facilitating the propagation of game.

In cooperation with the Bureau of Chemistry experiments were begun to determine the effects of cold storage on certain kinds of game. For this purpose a number of ducks of different species were obtained from North Carolina, with the aid of the secretary of the North Carolina Audubon Society, and a few prairie chickens were secured from Nebraska, through the courtesy of the chief deputy game and fish commissioner.

Two visits were made to Trenton, N. J., by a member of the Survey for the purpose of giving expert testimony before the Governor and the Senate committee on fish and game relative to the danger of continuing the spring shooting of waterfowl and summer shooting of woodcock, both of which practices are exceedingly detrimental to the several species concerned.

Aid was rendered game officials in California, Idaho, Illinois, North Dakota, Texas, Washington, Wisconsin, and Wyoming in various cases arising under the game laws of these States, and the Virginia Federation of Women's Clubs was assisted in the preliminary steps for the organization of a State Audubon society in Virginia.

TUSK HUNTING IN YELLOWSTONE PARK AND VICINITY.

Important cases were referred to in the last report arising from the killing of elk for their heads and teeth in the Yellowstone National Park and vicinity. After their conviction in April, 1907, at Pocatello, Idaho, on the charge of shipping heads and horns from Idaho to California in violation of the Lacey Act, two of the hunters, William Binkley and Charles Purdy, were immediately rearrested and held for trial at Fort Yellowstone for violation of the Yellowstone Park act in killing elk within the park limits. At the trial, which was held on September 10 before the United States commissioner,

Binkley and Purdy were convicted and sentenced to pay the costs in the case, amounting to $933, and to serve three months in jail. On November 14 indictments were secured at Cheyenne, Wyo., for Oscar Adams and Charles Isobel, the other two members of this noted gang of tusk hunters. These two men have not been apprehended, but the vigorous action of the Government has had the desired effect of breaking up these poaching operations, previously a menace to the game of the region.

ROUTINE WORK.

As the field work of the Survey increases and includes new lines of investigation, the amount of routine work increases correspondingly. This consists of correspondence; the preparation and editing of reports and bulletins on special subjects for publication; the identification and labeling of specimens, including those collected by our own assistants and also those sent in for identification by colleges, museums, and various individuals; the storage and care of field collections; cataloguing and identifying the contents of bird stomachs; tabulating field reports; sorting and filing published matter for future reference; mapping distribution of birds, mammals, and plants; supplying the needs of field assistants; developing photographic plates and making prints therefrom; compiling game laws; issuing permits for the entry of foreign mammals and birds, and for the export of trophies and specimens from Alaska; and cooperation in enforcing the various provisions of the act of Congress of May 25, 1900. The letters received during the year numbered about 7,166; the letters written during the year numbered 6,111, and the migration schedules sent out to observers, 734. During the year 930 negatives were made, illustrating and furnishing a most valuable supplementary record of the field work of the Survey. The series now numbers about 10,600 negatives.

OUTSIDE DEMANDS.

The above may be considered part of the regular duties of the Survey. In addition to these are constant demands for financial statements relative to field and office expenditures, the number and complexity of which are ever increasing; and requests from other Government Bureaus, and from special commissions, committees, and boards for reports on subjects apart from the duties of the Survey, but more or less distantly connected with them. These two classes of demands annually require the expenditure of much time and labor on the part of the Chief and his principal assistants, and constitute a heavy draft also on the small force of clerks. The subject is mentioned here in explanation of the fact that much time is annually consumed in the elaboration of results which do not appear as part of the output of the Survey. As no extra clerical assistance is provided, and no appropriation made for the expenses attendant on this extra service, it constitutes a heavy tax on the regular funds and necessitates the curtailment of other important work.

PUBLICATIONS.

The publications for the year include 5 bulletins, 1 Farmers' Bulletin, 4 Yearbook articles, 4 circulars, the Report of the Chief for

1907, and reprints of former publications. The bulletins are: No. 28, Game Commissions and Wardens, by R. W. Williams, jr.; No. 29, Relation of Birds to the Cotton Boll Weevil, by Arthur H. Howell; No. 30, Birds of California in Relation to the Fruit Industry, by F. E. L. Beal; No. 31, An Economic Study of Field Mice, by David E. Lantz; No. 32, Food Habits of the Grosbeaks, by W. L. McAtee. The Farmers' Bulletin is No. 308, Game Laws for 1907, by T. S. Palmer, Henry Oldys, and C. E. Brewster. The articles in the Yearbook for 1907 are entitled: The Rabbit as a Farm and Orchard Pest, by David E. Lantz; Does it Pay the Farmer to Protect Birds, by H. W. Henshaw; The Game Resources of Alaska, by W. H. Osgood; and Game Protection for 1907, by Henry Oldys. The titles of circulars are: No. 61, Hawks and Owls from the Standpoint of the Farmer, by A. K. Fisher; No. 62, Directory of Officials and Organizations Concerned with the Protection of Birds and Game, by T. S. Palmer; No. 63, Destruction of Wolves and Coyotes, Results Obtained during 1907, by Vernon Bailey; No. 64, Destruction of the Cotton Boll Weevil by Birds in Winter, by Arthur H. Howell.

The reprints of former publications issued are as follows: Bulletin No. 29, Relation of Birds to the Cotton Boll Weevil; Circular No. 32, second edition, revised, Directions for the Destruction of Prairie Dogs; Circular No. 60, revised, List of Publications of the Biological Survey.

OUTLINE OF WORK FOR 1909.

ECONOMIC ORNITHOLOGY AND MAMMALOGY.

Work on the food habits of birds and mammals will be continued along much the same lines as in previous years.

RELATION OF BIRDS TO THE BOLL WEEVIL.

As the boll weevil extends its range eastward from Texas through Louisiana, Mississippi, and other cotton-producing States, it will encounter new conditions, and it is important to study the effect of the insectivorous birds of the regions invaded on its progress. Accordingly it is intended during the coming season to continue investigations of the relations of birds to the pest, particularly in Louisiana, a considerable part of which State has already been entered by the weevil.

BIRDS IN RELATION TO THE FRUIT INDUSTRY.

Part 2 of a report on the relation of birds to the fruit industry in California is now nearly ready for the printer. The investigations carried on in middle California will be extended northward into the northern part of the State and into Oregon and Washington. In both the latter States fruit raising has assumed large proportions, while comparatively little is known of the birds living in or near orchards and of the nature of their food.

ENGLISH SPARROW.

Supplemental investigations in relation to the English sparrow are being carried on and will be continued during the coming year. Hitherto the pest has not invaded southern California to any extent,

and an attempt is being made, in conjunction with local and county officials, to exterminate it in the few places where it now is, with the purpose of preventing it from gaining a foothold in the fruit-raising sections of this region, where, if it becomes numerous, it is certain to do immense damage.

STARLING.

The starling, which was introduced into Central Park, New York, a number of years ago, has spread from that point as a center southward to northeastern Pennsylvania and northern New Jersey, eastward to central Connecticut, and northward up the Hudson River, thus occupying portions of four States. An attempt will be made this year to ascertain the exact distribution of this bird, the rapidity of its spread from New York, its relative abundance at the various points it now occupies, and the character of its food habits. This information is essential to devising means to check further increase of its range and to eradicate the pest, as far as possible, in the territory now occupied.

DIKE BORERS.

Experiments undertaken last year in Nevada to check the damage to irrigation dikes and embankments by burrowing rodents were highly successful, and the methods developed have been tried and pronounced by engineers to be simple and effective. It is intended to continue these in other irrigation districts and where necessary to send skilled assistants to demonstrate the methods recommended.

HOUSE RATS AND MICE.

World-wide efforts are now being made to abate or greatly lessen the nuisance of these pests. Though everywhere a steady tax on almost every product of human industry, their destruction is sought less on this account than because they constitute a menace to human health by carrying disease germs. The most effective remedies yet devised against them are various traps and poisons, which, however, have the disadvantage of requiring persistent use to be effective. The superiority of a bacterial preparation which, when fed to the animals, will cause a contagious disease, may readily be perceived. Several preparations declared to be of this kind have been placed on the market. Some of these have already been tested by the Survey and found wanting in the chief essential—communicability from rat to rat; others will be experimentally tested in the hope of ultimately securing a more efficient agent for use against these most noxious rodents.

FOX FARMING.

A Farmers' Bulletin on the subject of the rearing of the silver fox has been published, and the demand for it, as well as for further information on the subject, indicates a widespread interest in the business. So far the few breeders of the silver fox have been actuated solely by a desire for speedy returns from their investment, and hence have paid little or no attention to the improvement of breeding stock. Neither have satisfactory experiments been made as to the best food for foxes in confinement, the best method of handling breeding animals, and kindred subjects.

It is hoped that funds will be forthcoming to permit the establishment of an experimental farm where the animals may be handled to the best advantage and scientific methods may be employed in developing improved stock, not only of this fox but also of other valuable fur bearers. The information thus obtained will then be disseminated through publications with a view to instructing small farmers in the details of a business which, if properly pursued, can not fail to be remunerative.

DEER FARMING.

A great demand for the Farmers' Bulletin recently issued by the Biological Survey on Deer Farming shows the widespread interest in the subject; and numerous letters of inquiry prove the necessity for additional investigations and experiments. The fact that 20 deer can be kept at the cost of keeping a single cow, and that waste land or land now yielding little or no profit may be used for the purpose, goes far to explain the interest aroused. Further investigation as to the practical possibilities of the business will be undertaken for the purpose of preparing a more complete report.

GEOGRAPHIC DISTRIBUTION.

It is hoped to complete the life-zone work in several of the States where extensive gaps in our information still exist, as in California, Oregon, Washington, Idaho, Montana, Wyoming, the Dakotas, and Utah, in order to permit the publication of a life-zone map of the United States on a much larger scale than the one last issued, which is inadequate for detailed information. And it is planned to continue the more detailed surveys of the Pacific Coast region, the results to be embodied in a special map of each State.

GAME PROTECTION.

INSPECTION.

Efforts will be made to place the inspection service at Philadelphia on a more satisfactory basis. Most of the consignments to Philadelphia arrive by way of New York and have heretofore been inspected at either port. In future, so far as possible, inspections will be made at Philadelphia, in order to avoid delays en route and the difficulty of identifying birds, which can not be readily examined on shipboard or on the dock. However, importers will have the option of having their birds inspected at either port.

RECORDING DATA.

The consolidated card index of species imported since the Lacey Act became effective, May 25, 1900, will be continued. The work of ascertaining the dates of the first importations of different species into this country will continue, with special attention to the collection of data respecting the history of the early importations of the more important game birds.

PHEASANTS.

The material relating to imported pheasants collected by the Department will be prepared for publication in the form of a Farmers'

Bulletin on Pheasant Breeding in the United States. For the purpose of securing additional matter the more important pheasantries and private preserves will be examined.

PRESERVES.

Bird Reservations.—The bird reservations already established by executive order, or which have been examined with a view to recommendation for establishment, number 20 or more. Of these, 6 are in Florida, 4 in Louisiana, 2 in Michigan, 2 in North Dakota, 3 in Oregon, and 3 in Washington. The protection of the smaller reservations has been provided for in cooperation with the National Association of Audubon Societies, which has defrayed most of the actual cost of maintenance. Provision must be made for the proper maintenance of the larger reservations, however, and it is only proper that the expense of all these Federal establishments should be borne by the Government.

Bison Range.—Provision is made in the current appropriation bill for the acquisition and fencing of 12,800 acres of land on the Flathead Reservation, Mont., for a National Bison Range. This land will probably be ready by the close of the fiscal year, and it is possible that the herd offered by the American Bison Society can be delivered soon after that date. Maintenance of this herd for the year ending June 30, 1910, must therefore be provided for. Estimates for this item and for the proper maintenance of the bird reservations have been included in the regular estimates of the Bureau.

INFORMATION CONCERNING GAME.

The plan outlined several years ago of indexing the earlier statutes relating to game protection has been steadily continued and will be pressed as rapidly as possible. It has now progressed far enough to allow the publication of complete indexes of the laws of Michigan, Alabama, and probably California, during the coming year. It is probable that indexes of the laws of all the Rocky Mountain States also will be completed during the year; work on these will have preference on account of the important bearing the laws of these States have on the protection of big game. Unforeseen circumstances have delayed the completion of the index to game decisions, but the work has been brought down to date and will probably be completed during the year.

STATISTICS OF GAME ANIMALS.

It is necessary to effective work to have more exact figures concerning certain features of game protection. Statistics of the number of hunters in the United States and the amounts derived from fees for hunting licenses have been secured with some degree of completeness. It is hoped that during the year some plan can be adopted in cooperation with the several States to ascertain the quantity of big game killed each season, particularly the number of deer and elk, so as to secure a basis for an approximate estimate of the value of the big game of the country.

BIG GAME.

Last year special efforts were made to protect the elk by suppressing tusk and trophy hunting and poaching south of the Yellowstone

National Park. During the coming year the question of adequately protecting antelope will have first consideration. Efforts will be made to secure close seasons in every State in which antelope occur and to obtain similar protection in Canada. An attempt will be made also to ascertain the location of every large band of antelope now remaining in the United States and the approximate number of individuals in each band.

INTERSTATE COMMERCE IN GAME.

The personal examination of conditions governing illegal shipments of game in the Southwest, unavoidably deferred last year, will be made in the autumn of 1908. Information obtained in connection with the prosecution of the Binkley-Purdy case, already referred to, emphasizes the importance of collecting more complete data respecting the traffic in hides, horns, and tusks of big game as a prerequisite to successful conduct of similar cases in the future. One or two of the Western States and Canadian Provinces have adopted a system of marking heads or horns for shipment or sale, and the methods in use will be examined with a view to devising, if feasible, a simple and practicable means of so marking horns as to prevent the disposal of trophies obtained contrary to law.

In previous reports attention has been called to the necessity for the creation of several districts, each under a special agent or supervisor, charged with the duty of enforcing the provisions of the Lacey Act relating to interstate shipments of game. The importance of having an agent on the ground in close touch with local conditions is apparent, and it is strongly urged that the necessary funds be placed at the disposal of this Bureau. If only one such officer can be provided he should be stationed in the West, with headquarters at Chicago, where he can readily investigate shipments from the Lake region, the Northwest, and many points in the Southwest. The cost of this service, including salary and traveling expenses, would be inconsiderable, while the gain in effectiveness of enforcement of the Federal law would be great.

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